8th Sogo Bosai Seminar, DPRI, Kyoto University

Special Seminar on Environmental Hydrology by World Leading Hydrologists

Compartmentalization of the Terrestrial Water Cycle

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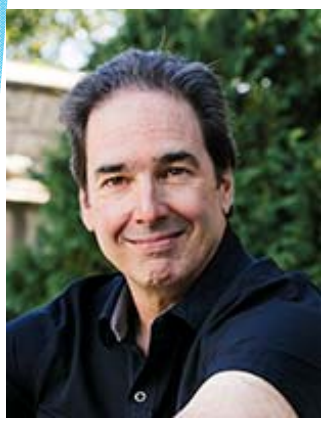

From Engineering Hydrology to Earth System Science: Milestones in the Transformation of Hydrologic Science

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Estimating Probabilistic Characteristics of Extreme Hydrologic Events and Largest-class Floods under Changing Climate

Prof. Yasuto Tachikawa
Department of Civil and Earth Resources Engineering,
Graduate School of Engineering, Kyoto University, Japan

Date: May 26, 2017
Place: Wood Composite Hall,
Uji Campus, Kyoto University
(京都大学宇治キャンパス、木質ホール 3Fセミナー室)

Schedule:

13:00 – 13:10 Opening Address by Prof. Takara
13:10 – 14:40 Invited Talk by Prof. McDonnell
14:50 – 16:20 Invited Talk by Prof. Sivapalan
16:30 – 17:30 Invited Talk by Prof. Tachikawa
17:30 – 18:00 Free Discussions

- *Compartmentalization of the Terrestrial Water Cycle*

  Prof. Jeffrey J. McDonnell

- **Abstract:** Our quantitative understanding of the terrestrial water cycle dates back to Pierre Perrault who in 1674 “measured” the water budget for a 145 km^2 headwater catchment of the River Seine near Dijon. He showed that rainfall volume explained sufficiently the water carried off by rivers and removed by evaporation. This study at last demonstrated that ‘underground condensation in reservoirs’ was not needed explain streamflow or plant transpiration---a concept previously debated since the ancient Greeks. Subsequently, the catchment water balance (inputs-outputs=change in storage) has become one of the most important equations in the geosciences and the major control on the cycling of solutes, contaminants and nutrients. But smooth rhythm of the terrestrial water cycle turns out to be more compartmentalized than previously thought. New isotopic tracing of the water cycle shows a distinct lack of mixing of water cycle components from global to micro scales. Here I describe some of this work and the impacts on how we understand and model streamflow, groundwater and plant transpiration.

- *From Engineering Hydrology to Earth System Science: Milestones in the Transformation of Hydrologic Science*

  Prof. Murugesu Sivapalan

- **Abstract:** Hydrologic science has undergone transformative changes in the past 50 years, from early empirical approaches to rigorous approaches based on the fluid mechanics of water movement on and below the land surface. Challenged by limitations of traditional Newtonian approaches, and embracing a Darwinian, co-evolutionary Earth system science perspective, development of hydrologic science is now guided by altogether new questions and new methodologies. In the emergent Anthropocene, this co-evolutionary view has expanded to involve feedbacks with human-social processes as well. In this lecture, I will present key milestones in the transformation of hydrologic science from Engineering Hydrology to Earth System Science.

- *Estimating Probabilistic Characteristics of Extreme Hydrologic Events and Largest-class Floods under Changing Climate*

  Prof. Yasuto Tachikawa

- **Abstract:** Probabilistic characteristics of extreme hydrologic events and largest-class flood flows under changing climate are discussed. To analyze the change of extreme rainfall characteristics, a non-stationary frequency model is applied for future extreme rainfall outputs projected by 20km resolution MRI-AGCM 3.2S. Then, a non-parametric method is used to estimate frequency relationships of extreme rainfall events and flood flows using a large ensemble of climate simulations. A physically based estimation of largest-class flood flows using a pseudo global warming typhoon experiment combined with a distributed rainfall-runoff model is also demonstrated. All estimation results show increasing tendencies of extreme rainfall events and flood flows.